

UNITED STATES PATENT OFFICE

JOHN WALTER GENUIT, OF HUNTINGTON PARK, CALIFORNIA, ASSIGNOR TO STOODY COMPANY, OF WHITTIER, CALIFORNIA, A CORPORATION OF CALIFORNIA

SINTERED HARD METAL ALLOY

No Drawing.

Application filed May 28, 1930. Serial No. 456,815.

My invention relates to a new composition of matter, and, in particular, to a formed sintered composition having valuable properties of hardness and resistance to abrasive wear and heat.

This new composition is intended for use on implements and machinery which must stand considerable abrasive wear and abuse and, in particular, as an insert metal on drilling bits which are used in the oil industry for making a hole through various hard, abrasive formations. These formations, due to their abrasive action and the heat generated by the cutting action, quickly wear down and destroy the cutting edges of the blades and cutters, thereby necessitating the frequent pulling and replacement of the bit.

Insert metals have heretofore been made in the electric arc furnace, and cast into shapes; but there are various defects incident to casting, such as piping and gas holes. These castings are broken up, sorted as to size, and utilized in various irregular shapes and sizes. It is an object of this invention to provide a sintered composition formed into shapes of uniform size suitable for easy manipulation and utility, and without the defects incident to casting just referred to above.

In particular, it is the object of my invention to provide a sintered tungsten carbide associated with molybdenum and tantalum having the required properties of hardness to withstand abrasive wear and resistance to heat.

My invention consists of the composition of matter hereinafter described and claimed:

I use as the principal constituents of my composition a finely powdered or pulverized tungsten carbide which may be made in a gas or electric furnace. This carbide is intimately mixed with finely powdered molybdenum and tantalum in the desired proportions, and then ball milled so that a finer-grained and more intimate mixture is obtained. A suitable agglutinant such as glycerine of a quantity just enough to make the mixture workable is added to the mixture, and the mass is molded into the shape and size desired under great pressure. I find a

pressure of about 30,000 pounds to the square inch to be very satisfactory, using a hydraulic or other press to compact the mass into such a rigid condition as to withstand ordinary handling and manipulation. By increasing the pressure, the agglutinant may be dispensed with and the mass be molded into articles readily handled. This formed compact material is then baked in a suitable furnace for two or three hours at a temperature of about 230° F. to drive off the agglutinant and produce a set, comparatively hard, material.

The molded and baked material is then placed in an electric or other furnace and surrounded by hydrogen or other non-oxidizing gas to preclude oxidation, and given a sintering heat for 5 to 20 minutes, the temperature ranging between 3,000 to 3,200° F., or thereabouts. It is not essential that a non-oxidizing gas be used in order to obtain a good product and it is well within the scope of my invention to sinter under atmospheric conditions, but I find that the desired properties of my composition are more sharply defined by using a non-oxidizing atmosphere. I am aware that resistance furnaces have heretofore been used to obtain a sintered product by conducting the heat current through the material to be sintered, the article acting as a resistance to the current, thereby obtaining a sintering temperature, but it is an essential element of my invention that an electric furnace be used in which the material does not act as a part of the electrical circuit, thereby obtaining greater ease of manipulation.

As a typical example, the following ingredients in the proportions stated may be used. To 880.76 grams of finely powdered tungsten carbide is added 9.08 grams of powdered molybdenum and 18.16 grams of powdered tantalum, which will give 97 percent tungsten carbide, 1 percent molybdenum, and 2 percent tantalum.

The present commercial impracticability of using pure tantalum, and the procuring or producing of a tungsten carbide of a carbon content of the value of the theoretical percentage makes it desirable to use ferro-tanta-

lum in place of the tantalum in the above mix, the ferro-tantalum containing about 20 percent iron, and also having the desirable property of lowering the sintering temperature of the mixture. A representative mix of the constituents would be as follows: To 876.22 grams of tungsten carbide of from 5.8 to 6.1 percent combined carbon content and from 6.2 to 6.4 per cent total carbon content, unwashed, is added 4.54 grams of free tungsten power to give a theoretical tungsten carbide WC of 6.08 carbon content. To this mixture is added a mixed 9.08 grams of powdered molybdenum and 18.16 grams of ferro-tantalum, the latter containing about 20 percent of iron.

The above indicated weights give tungsten carbide and free tungsten 97 percent, molybdenum 1 percent, and ferro-tantalum 2 percent, of the composition. Molybdenum carbide may be substituted in the mix in the same proportion as molybdenum if such a composition is desired.

The above indicated tungsten carbide of formula WC used in the above specific charge may be replaced by one of the lower carbides of the order of W_2C and W_3C or by any of the eutectics with a corresponding change in the amount of free tungsten added to reach the theoretical eutectic point desired. It is also practical to use a molybdenum carbide in the same proportions as the powdered metal molybdenum in the composition.

Compositions containing tungsten carbide and molybdenum are old in the art but such compositions do not have the wear resisting and heat resisting qualities as when tantalum is added as above described, tantalum forming an essential ingredient in the above composition.

The mixture when given the process and sintering heat treatment as outlined above gives a metal composition having the properties of hardness and appearance or shape which suit it for insert metal work and utility.

It will be understood by those skilled in the art that proportions of the constituents may be changed within certain limits and yet produce an excellent material for the uses intended. The tungsten carbide may range between 90 to 97 percent by weight, the molybdenum or the molybdenum carbide .5 to 5 percent, and the tantalum 2 to 9.5 percent.

I claim:

1. A sintered hard metal composition comprising a carbide of tungsten, molybdenum, and tantalum, the tungsten carbide being between 90-97 percent by weight, the molybdenum 0.5-5.0 percent by weight and the tantalum 2.0-9.5 percent by weight, respectively of the whole composition.

2. A sintered hard metal composition comprising a carbide of tungsten, molybdenum carbide and tantalum, the tungsten carbide being between 90-97 percent by weight, the

molybdenum carbide 0.5-5.0 percent by weight and the tantalum 2.0-9.5 percent by weight respectively of the whole composition.

3. A sintered hard metal composition comprising a carbide of tungsten, molybdenum and tantalum, the tungsten carbide being 97 percent, the molybdenum 1 percent and the tantalum 2 percent by weight respectively of the whole composition.

4. A sintered hard metal composition comprising a carbide of tungsten, molybdenum carbide and tantalum, the tungsten carbide being 97 percent, the molybdenum carbide 1 percent and the tantalum 2 percent by weight respectively of the whole composition.

5. A sintered hard metal composition made of a carbide of tungsten, molybdenum and ferro-tantalum, the tungsten carbide being between 90-97 percent by weight, the molybdenum 0.5-5.0 percent by weight and the ferro-tantalum 2.0-9.5 percent by weight respectively of the whole composition.

6. A sintered hard metal composition made of a carbide of tungsten, molybdenum carbide, and ferro-tantalum, the tungsten carbide being between 90-97 percent by weight, the molybdenum carbide 0.5-5.0 percent by weight and the ferro-tantalum 2.0-9.5 percent by weight respectively of the whole composition.

7. A sintered hard metal composition made of a carbide of tungsten, molybdenum and ferro-tantalum, the tungsten carbide being 97 percent by weight, the molybdenum 1 percent and the ferro-tantalum 2 percent by weight respectively of the whole composition.

8. A sintered hard metal composition made of a carbide of tungsten, molybdenum carbide and ferro-tantalum, the tungsten carbide being 97 percent by weight, the molybdenum carbide 1 percent and the ferro-tantalum 2 percent by weight respectively of the whole composition.

9. A sintered hard metal composition having approximately the following composition; ninety-seven percent tungsten carbide, one percent of one of the group composed of molybdenum and molybdenum carbide, and two percent of one of the group composed of tantalum and ferro-tantalum.

In testimony whereof I have signed my name to this specification.

JOHN WALTER GENUIT.